A Low-Frequency Selective Amplifier

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A number of frequency-selective amplifiers at low frequencies have been developed for various purposes[1]. In connection with dielectric measurements a simple selective amplifier was built for null detection in bridge measurements and for standing wave measurements at microwave frequencies. The amplifier described here is featured with linear high amplification and high selectivity of frequency. The circuit diagram of the amplifier including an indicator is shown in Fig. 1. For obtaining a frequency-selective characteristic a twin T network was used in the feedback loop of the amplifier stage of V-3, a 6AU6 tube, where a cathode follower was employed to meet a no-load condition on the selective network. The null frequency varied continuously form 30 cps to 3 kc with the indicated values of components of the network in which non-linear variable resistors such as antenns bias type were used for VR_2 and VR_3. Since the selectivity of frequency is proportional to the amplification of V-3, the selectivity or the Q value of circuit as well as the amplifier gain depends on the grid-bias potential of V-3 that is fed from the 50 kilohm potentiometer VR_1. A Q value of 30 or more was obtained with a proper setting of VR_1. A typical rejection curve is shown in Fig. 2. The total gain of the amplifier was about 120 db at the mixiumum gain setting and 20 microvolt input was sufficient to give full deflection on the indicator. The hum or noise level was minimized by dc heating of V-1 to V-4, being less than 0.2 microvolts at full gain in terms of the input level. The twin T network encased in a shielding can was made a plug-in replacement type. When it was replaced with a 500 kilohm grid-leak resistor (Fig. 1), the amplifier showed a wide-band operation in a frequency range of 30 cps to 100 kc within 6 db of the amplitude characteristic.

The indicator circuit was straightforward which consisted of a rectifier V-6 and a tube voltmeter of the cathode follower type V-7. The indicator of a 0-1 ma meter showed rapid response with minimum overshoot. A voltage output of about 25 volts on the stage of V-5 was enough to give full deflection of the indicator. The voltmeter tube 12AU7 should be selected to obtain the minimum zero drift of the indicator.

Revision for wider band operation is now in progress.

REFERENCE

(1) E.g. G. E Valley, Jr. and H. Wallman, "Vacuum Tube Amplifier" (McGraw-Hill Book Company, Inc. New York, 1948), Chapter 10.

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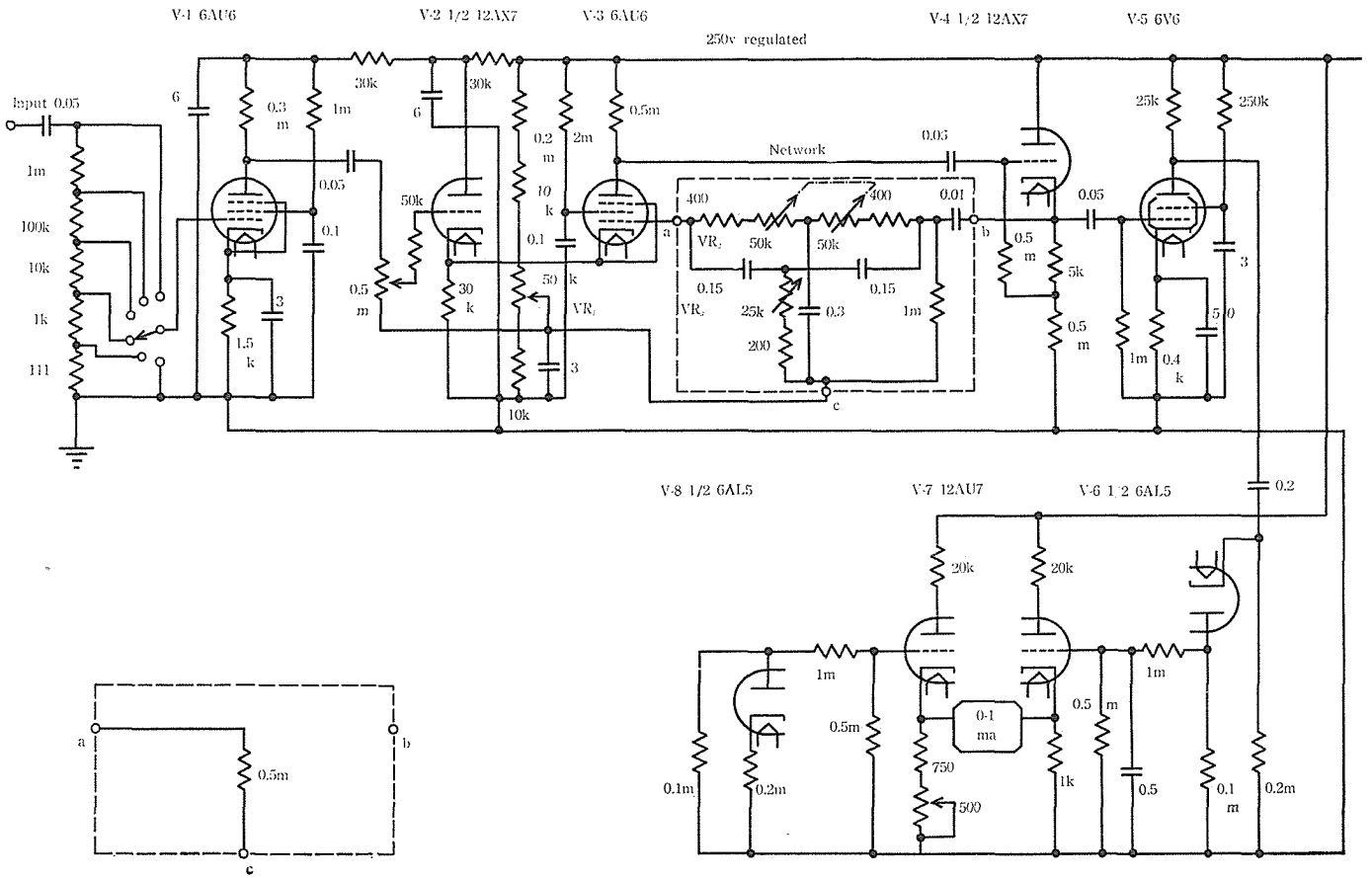

Fig. 1. Circuit diagram of selective amplifier.

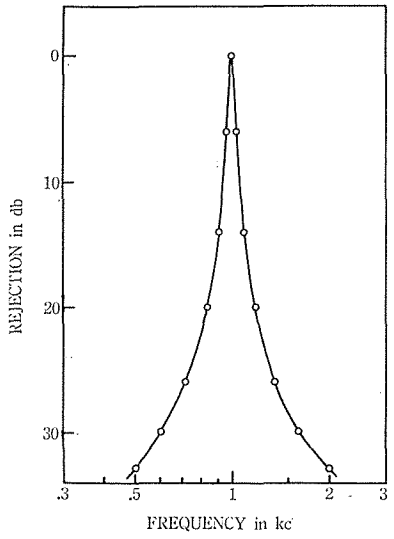

Fig. 2. Typical rejection curve at 1 kc.